

CLAIMS

1. A flip-chip-type gallium nitride compound semiconductor light-emitting device comprising a substrate, an n-type semiconductor layer, a light-emitting layer, a p-type semiconductor layer, a negative electrode provided on the n-type semiconductor layer, and a positive electrode provided on the p-type semiconductor layer, the layers being successively provided atop the substrate in this order and being composed of a gallium nitride compound semiconductor, wherein the positive electrode has a three-layer structure comprising an ohmic electrode layer which is in contact with the p-type semiconductor layer, an adhesion layer which is provided on the ohmic electrode layer, and a bonding pad layer provided on the adhesion layer, each melting point of these layers being lowered in this order.

2. A flip-chip-type gallium nitride compound semiconductor light-emitting device according to claim 1, wherein the ohmic electrode layer is composed of a metal selected from the group consisting of Rh, Pt and Ir, or composed of an alloy containing at least one of these metals.

3. A flip-chip-type gallium nitride compound semiconductor light-emitting device according to claim 2, wherein the ohmic electrode layer is composed of Rh.

4. A flip-chip-type gallium nitride compound semiconductor light-emitting device according to any one of claims 1 to 3, wherein the adhesion layer is composed of Ti or Cr.

5. A flip-chip-type gallium nitride compound semiconductor light-emitting device according to claim 4, wherein the adhesion layer is composed of Ti.

6. A flip-chip-type gallium nitride compound semiconductor light-emitting device according to any one of claims 1 to 5, wherein the bonding pad layer is composed of a metal selected from the group consisting of gold, aluminum, nickel, and copper, or composed of an

alloy containing at least one of these metals.

5       7.    A flip-chip-type gallium nitride compound semiconductor light-emitting device according to any one of claims 1 to 6, wherein the adhesion layer has a thickness of 10 Å to 1,000 Å.

      8.    A flip-chip-type gallium nitride compound semiconductor light-emitting device according to claim 7, wherein the adhesion layer has a thickness of 10 Å to 100 Å.

10       9.    A flip-chip-type gallium nitride compound semiconductor light-emitting device according to any one of claims 1 to 8, wherein the ohmic electrode layer has a thickness of 100 Å to 3,000 Å.

15       10.   A flip-chip-type gallium nitride compound semiconductor light-emitting device according to claim 9, wherein the ohmic electrode layer has a thickness of 500 Å to 2,000 Å.

20       11.   A flip-chip-type gallium nitride compound semiconductor light-emitting device according to any one of claims 1 to 10, wherein the bonding pad layer has a thickness of at least 1,000 Å.

25       12.   A flip-chip-type gallium nitride compound semiconductor light-emitting device according to claim 11, wherein the bonding pad layer has a thickness of 3,000 Å to 5,000 Å.

      13.   A flip-chip-type gallium nitride compound semiconductor light-emitting device according to any one of claims 6 to 12, wherein the bonding pad layer is composed of gold.

30       14.   A positive electrode for use in a gallium nitride compound semiconductor light-emitting device, wherein the positive electrode has a three-layer structure comprising an ohmic electrode layer which is brought into contact with a p-type semiconductor layer of  
35       the compound semiconductor light-emitting device, an adhesion layer which is provided on the ohmic electrode layer, and a bonding pad layer provided on the adhesion

layer, each melting point of these layers being lowered in this order.

5           15. A positive electrode for use in gallium nitride compound semiconductor light-emitting device according to claim 14, wherein the ohmic electrode layer is composed of a metal selected from the group consisting of Rh, Pt and Ir, or composed of an alloy containing at least one of these metals.

10           16. A positive electrode for use in gallium nitride compound semiconductor light-emitting device according to claim 15, wherein the ohmic electrode layer is composed of Rh.

15           17. A positive electrode for use in gallium nitride compound semiconductor light-emitting device according to any one of claims 14 to 16, wherein the adhesion layer is composed of Ti or Cr.

            18. A positive electrode for use in gallium nitride compound semiconductor light-emitting device according to claim 17, wherein the adhesion layer is composed of Ti.

20           19. A positive electrode for use in gallium nitride compound semiconductor light-emitting device according to any one of claims 14 to 18, wherein the bonding pad layer is composed of a metal selected from the group consisting of gold, aluminum, nickel, and copper, or composed of an alloy containing at least one of these metals.

25           20. A positive electrode for use in gallium nitride compound semiconductor light-emitting device according to any one of claims 14 to 19, wherein the adhesion layer has a thickness of 10 Å to 100 Å.

30           21. A positive electrode for use in a gallium nitride compound semiconductor light-emitting device according to claim 20, wherein the adhesion layer has a thickness of 30 Å to 50 Å.

35           22. A light-emitting diode comprising a flip-chip-type gallium nitride compound semiconductor light-emitting device according to any one of claims 1 to 13.

            23. A lamp comprising a flip-chip-type gallium

nitride compound semiconductor light-emitting device  
according to any one of claims 1 to 13.